Crest Factor Reduction For Ofdm Based Wireless Systems

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Boonton Electronics: Peak Power and Crest FactorCrest Factor Reduction For Ofdm

Crest Factor Reduction for OFDM-Based Wireless Systems Altera Corporation 2 After clipping, the PAR of the signal is reduced, making it possible to transmit the new signal. However, the polar clipping results in distortion (and perhaps unrecoverable errors) in the constellation symbols. In addition, the

Crest Factor Reduction for OFDM-Based Wireless Systems

Introduction Crest factor reduction (CFR) is a technique for reducing the peak-to-average ratio (PAR) of an orthogonal frequency division multiplexing (OFDM) waveform. An OFDM signal is made up in the frequency domain as a set of orthogonal carriers that are each modulated by a constellation symbol. The main disadvantage of OFDM modulation is

AN 475: Crest Factor Reduction for OFDMA Systems

OFDM presents a problem of a high crest factor or Peak to Average Power Ratio (PAPR). To circumvent this problem either High Power Amplifiers (HPA s) with large dynamic range or PAPR reduction techniques are used. The former scheme increases cost of the system while the latter introduces redundancy or distortion.

Crest Factor Reduction of an OFDM/WiMAX Network ...

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Crest Factor Reduction For Ofdm Based Wireless Systems

standard with a physical layer based on OFDM. An improved PAPR / crest factor reduction technique was developed by combining the ideas of selected mapping and tone reservation which are popular PAPR reduction techniques. 3.2 Variables The amount of PAPR reduction is determined by the peak reduction tones (additive signals)

Crest Factor Reduction of an OFDM/WiMAX Network

Abstract—In this paper, we propose a constrained clipping method for reducing the peak to average power ratio (PAR) or crest factor of an orthogonal frequency division multiplexing (OFDM) signal. This is a transmitter-side processing technique that does not impose any modification at the receiver.

Constrained Clipping for Crest Factor Reduction in OFDM

Many crest factor reduction techniques (CFR) have been proposed for OFDM. The reduction in crest factor results in a system that can either transmit more bits per second with the same hardware, or transmit the same bits per second with lower-power hardware (and therefore lower electricity costs and less expensive hardware), or both.

Crest factor - Wikipedia
f (x) = 1 / (σ 2 π) exp. . (− (x − μ) 2 / (2 σ 2)) For OFDM μ = 0. When we calculate crest factor we need to define the number of samples to be used for measurement. We say measurement for 1 e + 6 samples is valid since crest factor doesn't increase significantly, when we take more values.

digital communications - Crest Factor of OFDM signal ...
So remedies are taken to reduce the PAPR of the OFDM signal so that smaller power PA device could be used in the system. Crest Factor Reduction (CFR) CFR is a technique used to reduce the PAPR (Peak To Average Power Ratio) of the transmitted signal so that the power amplifier can operate more efficiently.

What is PAPR (Peak to average power ratio), Why it matters ...
The two technologies are commonly known as " crest factor reduction " and " digital predistortion " (DPD). A well-designed PA with CFR and DPD can achieve efficiency of about 30% in a typical OFDM application. This is a threefold increase in output power for the same PA circuit and power consumption.

Crest Factor - an overview ¦ ScienceDirect Topics
Improved Power Efficiency The GC1115 Crest Factor Reduction (CFR) Processor from Texas Instruments (TI) significantly improves the power efficiency of wireless base station power amplifiers (PAs) by reducing output signal peaks.

Key Features GC1115 Crest Factor Reduction Processor
Disclosed herein are a novel crest factor reduction (CFR) technique and apparatus that provide for orthogonal frequency division multiplexing (OFDM) systems using blind selected pilot tone...

US20060274868A1 - Crest factor reduction in OFDM using ...
The crest factor CF (in dB) for an OFDM system with n uncorrelated subcarriers is = + where CF c is the crest factor (in dB) for each subcarrier. (CF c is 3.01 dB for the sine waves used for BPSK and QPSK modulation).

Orthogonal frequency-division multiplexing - Wikipedia
Large Crest Factors results in lower RF Power Amplifier efficiency due to the need for larger backoff. The goal of this project is to evaluate the performance of the various CF reduction techniques that has been proposed to-date, such as noise shaping and peak cancellation. • OFDM Simulink Transmitter Model using 16QAM and 2000+ subcarriers

OFDM crest factor reduction technique using matlab ...
Crest factor reduction (CFR) technology can reduce the PAPR so that the back-off of the radio frequency power amplifier can be reduced. This paper describes a new PAPR reduction scheme for OFDM. By using space band spectrum, the schemes have lower EVM degradation.

Crest factor reduction for TD-LTE base station - IEEE ...
Georgia Tech inventors have created a crest factor reduction (CFR) technique and apparatus that provide for OFDM systems using blind selected pilot tone modulation. The technique combines the merits of PTAM and SLM, and is implemented using a joint channel estimation and crest factor reduction algorithm.

Blind Selected Mapping for OFDM ¦ Office of Industry ...
Orthogonal frequency-division multiplexing (OFDM) is a very promising modulation technique; perhaps its biggest problem is its high crest factor. Many crest factor reduction techniques (CFR) have been proposed for OFDM.

Distortion-based crest factor reduction (CFR) algorithms were studied in orthogonal frequency division multiplexing (OFDM) and multiple-input multiple-output (MIMO) OFDM systems to reduce the nonlinear distortion and improve the power efficiency of the transmitter front-end. First, definitions of peak-to-average-power ratio (PAR) were clarified based on the power efficiency improvement consideration in the MIMO-OFDM systems. Next, error vector magnitude (EVM) was used as the in-band performance-evaluating metric. Statistical analysis of EVM was performed to provide concrete thresholds for the amount of allowable distortions from each source to meet EVM requirements in the standard. Furthermore, an effective CFR technique, constrained clipping, was proposed to drastically reduce the PAR while satisfying any given in-band EVM and out-of-band spectral mask constraints. Constrained clipping has low computational complexity and can be easily extended to the multiple-user OFDM environment. Finally, signal-to-noise-and-distortion ratio (SNDR) analysis for transceiver nonlinearities in the additive white Gaussian noise channel was investigated. An analytical solution was presented for maximizing the transceiver SNDR for any given set of nonlinear transmitter polynomial coefficients. Additionally, mutually inverse pair of transceiver nonlinearities was shown to be SNDRoptimal only in the noise-free case.

Covering everything from signal processing algorithms to integrated circuit design, this complete guide to digital front-end is invaluable for professional engineers and researchers in the fields of signal processing, wireless communication and circuit design. Showing how theory is translated into practical technology, it covers all the relevant standards and gives readers the ideal design methodology to manage a rapidly increasing range of applications. Step-by-step information for designing practical systems is provided, with a systematic presentation of theory, principles, algorithms, standards and implementation. Design trade-offs are also included, as are practical implementation examples from real-world systems. A broad range of topics is covered, including digital pre-distortion (DPD), digital up-conversion (DUC), digital down-conversion (DDC) and DC-offset calibration. Other important areas discussed are peak-to-average power ratio (PAPR) reduction, crest factor reduction (CFR), pulse-shaping, image rejection, digital mixing, delay/gain/imbalance compensation, error correction, noise-shaping, numerical controlled oscillator (NCO) and various diversity methods.

Wireless voice and data communications have made great improvements, with connectivity now virtually ubiquitous. Users are demanding essentially perfect transmission and reception of voice and data. The infrastructure that supports this wide connectivity and nearly error-free delivery of information is complex, costly, and continually being improved. This resource describes the mathematical methods and practical implementations of linearization techniques for RF power amplifiers for mobile communications. This includes a review of RF power amplifier design for high efficiency operation. Readers are also provided with mathematical approaches to modeling nonlinear dynamical systems, which can be applied in the context of modeling the PA for identification in a pre-distortion system. This book also describes typical approaches to linearization and digital pre-distortion that are used in practice.

Orthogonal frequency-division multiplexing (OFDM) is a method of digital modulation in which a signal is split into several narrowband channels at different frequencies. CDMA is a form of multiplexing, which allows numerous signals to occupy a single transmission channel, optimising the use of available bandwidth. Multiplexing is sending multiple signals or streams of information on a carrier at the same time in the form of a single, complex signal and then recovering the separate signals at the receiving end. Multi-Carrier (MC) CDMA is a combined technique of Direct Sequence (DS) CDMA (Code Division Multiple Access) and OFDM techniques. It applies spreading sequences in the frequency domain. Wireless communications has witnessed a tremendous growth during the past decade and further spectacular enabling technology advances are expected in an effort to render ubiquitous wireless connectivity a reality. This technical in-depth book is unique in its detailed exposure of OFDM, MIMO-OFDM and MC-CDMA. A further attraction of the joint treatment of these topics is that it allows the reader to view their design trade-offs in a comparative context. Divided into three main parts: Part I provides a detailed exposure of OFDM designed for employment in various applications Part II is another design alternative applicable in the context of OFDM systems where the channel quality fluctuations observed are averaged out with the aid of frequency-domain spreading codes, which leads to the concept of MC-CDMA Part III discusses how to employ multiple antennas at the base station for the sake of supporting multiple users in the uplink Portrays the entire body of knowledge currently available on OFDM Provides the first complete treatment of OFDM, MIMO(Multiple Input Multiple Output)-OFDM and MC-CDMA Considers the benefits of channel coding and space time coding in the context of various application examples and features numerous complete system design examples Converts the lessons of Shannon ’ s information theory into design principles applicable to practical wireless systems Combines the benefits of a textbook with a research monograph where the depth of discussions progressively increase throughout the book This all-encompassing self-contained treatment will appeal to researchers, postgraduate students and academics, practising research and development engineers working for wireless communications and computer networking companies and senior undergraduate students and technical managers.

Power amplifiers are essential components in wireless communication systems and are inherently nonlinear. This nonlinearity generates spectral regrowth beyond the signal bandwidth, which in turn interferes with adjacent channels. Wideband code division multiple access (WCDMA) and orthogonal frequency division multiplexing (OFDM) systems are particularly vulnerable to nonlinear distortions; this is due to their high peak-to-average power ratios (PAPRs), which require a stringent linearity. One way to achieve the required linearity is to back-off the input signal. However, in the case of high PAPR signals, the efficiency of the power amplifier will be very low. In this dissertation, we are concerned with achieving high linearity and high efficiency. We first propose a predistorter based on piecewise pre-equalizers, for use in multi-channel wideband applications. This predistortion linearizer consists of piecewise pre-equalizers, along with a lookup table (LUT) based digital predistorter; together they compensate for nonlinearities, as well as memory effects of power amplifiers. Taking advantage of the multiple finite impulse response (FIR) filters, the complexity is significantly reduced when compared to memory polynomial methods. Furthermore, experimental results obtained when two WCDMA carriers were applied verified that our proposed method provides improvements comparable to those seen using the memory polynomial approach. Secondly, a unique baseband derived radio frequency (RF) predistortion system is presented, which uses LUT coefficients extracted at baseband to directly RF envelope modulate a quadrature vector modulator. The primary advantage of this architecture is that it combines the narrowband benefit of envelope predistortion with the accuracy of baseband predistortion. Finally, a novel efficient crest factor reduction technique for wideband applications is described. The technique uses peak cancellation to reduce the PAPR of the input signal. Conventional iterative peak cancellation requires several iterations to converge to the targeted PAPR, since filtering causes peak re-growth. The proposed algorithm eliminates several iterations and subsequently saves hardware resources. A direct performance comparison between a digitally predistorted and a feed-forward linearized Doherty amplifier is provided, under various crest factor reduction levels.

Envelope tracking technology is seen as the most promising efficiency enhancement technology for RF power amplifiers for 4G and beyond wireless communications. More and more organizations are investing and researching on this topic with huge potential in academic and commercial areas. This is the first book on the market to offer complete introduction, theory, and design considerations on envelope tracking for wireless communications. This resource presents you with a full introduction to the subject and covers underlying theory and practical design considerations.

Now available in a three-volume set, this updated and expanded edition of the bestselling The Digital Signal Processing Handbook continues to provide the engineering community with authoritative coverage of the fundamental and specialized aspects of information-bearing signals in digital form. Encompassing essential background material, technical details, standards, and software, the second edition reflects cutting-edge information on signal processing algorithms and protocols related to speech, audio, multimedia, and video processing technology associated with standards ranging from WiMax to MP3 audio, low-power/high-performance DSPs, color image processing, and chips on video. Drawing on the experience of leading engineers, researchers, and scholars, the three-volume set contains 29 new chapters that address multimedia and Internet technologies, tomography, radar systems, architecture, standards, and future applications in speech, acoustics, video, radar, and telecommunications. This volume, Wireless, Networking, Radar, Sensor Array Processing, and Nonlinear Signal Processing, provides complete coverage of the foundations of signal processing related to wireless, radar, space–time coding, and mobile communications, together with associated applications to networking, storage, and communications.

Power Efficiency in Broadband Wireless Communications focuses on the improvement of power efficiency in wireless communication systems, especially of mobile devices. Reviewing cutting-edge techniques for conserving power and boosting power efficiency, the book examines various technologies and their impact on consumer devices. It considers each technology, first by introducing the main physical layer components in recent wireless communication systems along with their shortcomings, and then proposing solutions for overcoming these shortcomings. The book covers orthogonal frequency division multiplexing (OFDM) signal generation and formulation and examines the advantages and disadvantages of OFDM systems compared to alternative multiplexing. It introduces one of the main drawbacks of OFDM systems, peak-to-average power ratio (PAPR), and discusses several PAPR techniques. It also explains how to overcome the main drawbacks of real-world OFDM system applications. Considers power amplifier linearization for increasing power efficiency and reducing system costs and power dissipation Describes the implementation scenario of the most promising linearization technique, digital predistortion Presents some experimental demonstrations of digital predistortion when the device under test is in the loop Because the most costly device in a communication system that has a direct impact on power efficiency and power consumption is the power amplifier, the book details the behavior and characteristics of different classes of power amplifiers. Describing the evolution of the mobile cellular communication system, it details a cost-effective technique to help you increase power efficiency, reduce system costs, and prolong battery life in next generation mobile devices.

The two volume set, CCIS 288 and 289, constitutes the thoroughly refereed post-conference proceedings of the First International Conference on Communications and Information Processing, ICCIP 2012, held in Aveiro, Portugal, in March 2012. The 168 revised full papers of both volumes were carefully reviewed and selected from numerous submissions. The papers present the state-of-the-art in communications and information processing and feature current research on the theory, analysis, design, test and deployment related to communications and information processing systems.